SCIENCE & GOVERNMENT REPORT

10th Year of Publication

The Independent Bulletin of Science Policy

Vol. X, No. 1 | P.O. Box 6226A, Washington, D.C. 20015 | January 15, 1980

Cuts Studied in US-USSR Science Cooperation

The officials who preside over the government's research and development enterprise were responding last week to political directives to identify joint US-USSR activities that might be axed in support of Jimmy Carter's new punish-the-Russians program.

But so far, as might be expected, confusion outweighs policy, and about the only clear signal given to the federal R&D hierarchy is that senior officials should show restraint when it comes to carrying out planned meetings with the Soviets. We've been through this before, of course, as was the case when various high-level research- and health-related pow-wows with the Soviets were put off by American government representatives while the Russians were cracking down on "refusenik" dissidents. So far, in asking around R&D circles, the only crisis-induced overt act that SGR could turn up involves the head of the National Institute for Occupational Health and Safety, who "postponed" a visit to the Soviet Union. Postponed is the word that was used in previous efforts to convince the Soviets of our displeasure, though no one is able to provide any evidence concerning what effects these delays, or even cancellations—as they sometimes turned out to be—have on what we regard as the Soviets' beastly behavior.

Some Blunt Talk to Congress About R&D Policy---Page 3

The dozen or so collaborative R&D agreements that trace back to the Nixon-Brezhnev embrace of 1972 offer many opportunities for showing repudiation of a willingness to deal with the Russians. But people in Washington who specialize in monitoring these east-west contacts doubt that the Soviets regard any of them as critical to their scientific and technological well-being. The sort of tit-for-tat dealings that are carefully written into the agreements virtually assures that, while they may be personally congenial for the participants, they assure that neither nation gets more than the other is willing to concede. And, since the Soviets persist with their xenophobia, and lift the curtain only as much as is necessary to win some American cooperation, relatively little science and technology actually flows along these elaborately negotiated channels of exchange. The very existence of legally hammered out guidelines is evidence of the constricted nature of these channels.

One source of hesitation for cutting back on even these limited dealings with the Soviet Union is that the exchanges and collaborative programs — in energy, environment, health, space, science policy, and so on — have provided the US with some previously unavailable peeks into the Soviet research establishment.

It's still the case, as observers of the Soviet research scene have repeatedly noted, that important institutions and people in Soviet R&D are successfully hidden from the west. But the fact is that, in recent years, as a direct result of the increase in east-west R&D traffic — small though it may be in comparison with the easy-running R&D relations that the US has with other nations — we possess an unprecedented amount of information about the inner workings of Soviet R&D. And, given the intense interest that we have in Soviet military and economic capabilities, it is doubtful that we'd lightly foreclose the use of our best peephole on the R&D underpinnings of those capabilities.

Conversations with Washington science-policymakers reveals that the new decade brings with it — at very long last — the realization that the US position in the world's R&D just isn't what it used to be. Western Europe is

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In Brief

The federal government is neglecting basic research in its own multi-billion-dollar empire of in-house laboratories, according to a new, hardhitting report by the General Accounting Office. While academic labs have gotten relief from Washington, fundamental science in federal facilities has been on a long, downward slide — and it's likely to continue that way, says the GAO. The report, "Federal R&D Laboratories — Directors' Perspectives on Management," is available without charge from: GAO, Room 1518, 441 G St. Nw., Washington, DC. Ask for Publication PSAD-80-8.

What's the Justice Department's Anti-trust Division doing in response to last October's presidential pledge of a clarification of policy on industrial research collaboration? Well, it has finally completed a draft statement, but not even top-level officials responsible for running the Administration's innovation-boosting efforts have seen it.

As for tax incentives to promote industrial R&D — that's to be taken up in a big, new tax "package," but with White House attention divided between re-election and foreign worries, tax reform is definitely low priority.

. . . Defense R&D Heading for Big Boost

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fully restored as a major competitor to the US in basic science, technology, and, as has long been painfully evident, in technologically advanced industry. Japan is similarly strong, and it also turns out that some of the less-developed nations, India and South Korea, for example, are not so less-developed in many important scientific and technical respects.

All of which means a substantial reduction in America's opportunities for using science and technology as punishment and reward in dealing with the Soviets. It is doubtful that any combination of nations can help them out as well as the US can in making up for poor harvests, and the US continues to have an edge in high-powered computers and oil-drilling equipment — both of which the Soviets greatly covet. But in most fields of science, technology, and advanced industrial products, the US is no longer the sole source. France, which does a big and growing high-technology business with the Soviets, has already indicated that it's not at all sympathetic to Mr. Carter's punishment ploys; the French, instead, look upon this peculiar American obsession with faraway Afghanistan as a windfall opportunity for more business.

The resumption of the Cold War could very well mean that Congress and the Executive will be adopting a more protective, generous, and sympathetic attitude toward the care and feeding of R&D. It has now penetrated to all but the densest of our public servants that the vitality of the research enterprise is fundamentally important in this increasingly troubled world. Afghanistan came along too late to affect the budget that Mr. Carter will send to Congress next week, but the supplemental appropriations process is always available for financing afterthoughts.

The biggest gainer will be the Defense Department, which, riding the Iranian crisis, was singled out for major increases even before the Soviet invasion of Afghanistan. Defense got a big boost for R&D in the last budget go-round — about 13 per cent — and it's likely to get similar treatment in the 1981 budget, including additional funds for its long-cherished goal of regaining its pre-Vietnam position as a major supporter of academic research.

The National Science Foundation, hovering just a few millions short of the billion-dollar mark in its most recent appropriation, can be expected to break that barrier by a good amount. For doing so, it will derive considerable benefit from the argument that the basic science it supports is a major element in national security.

As for the National Institutes of Health: Deeply enmeshed in the complexities of the budget-planning process that was bestowed upon it by Joe Califano when he was Secretary of Health, Education, and Welfare, NIH may soon emerge as the most rational budget-planning operation in the federal system. But the major political reality in NIH affairs is that Congress shares the public's great hopes for biomedical research, and is therefore inclined to pile on the money. There's never enough, of course, to meet fully the ambitions of the biomedical research community or to compensate for the cunning niggardliness of the Office of Management and Budget. But, with only occasional exceptions, the final reckoning shows that NIH remains a favorite on Capitol Hill.—DSG

Sino-US R&D Talks Slated

Presidential Science Adviser Frank Press will head a high-level delegation of US research officials on a four-day visit to Peking, starting January 19.

The visit is the first of an annual exchange agreed to last year when Press, with a similar delegation, negotiated a series of Sino-American science and technology agreements. Given the rapidly accelerating frost in US-USSR relations, and a past pattern of the US warming up to China in such circumstances, there's a strong likelihood of still closer Sino-American links coming out of next week's visit.

Press' party will include the directors of the National Science Foundation, the National Institutes of Health, the Geological Survey, and senior R&D officials from the departments of Energy and Agriculture, plus the President of the National Academy of Sciences.

ISSN 0048-9581

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Independently published by *Science & Government Report,* Inc., twice monthly, except once each in January, June & July. Annual Subscription: Institutions, $89.50 (two years, $168.50); individuals, $48.50 (two years, $82.50). Editorial offices at 3736 Kanawha St., N.W., Washington, DC 20015. Tel. (202) 244-4135. Second class postage paid at Washington, DC. Please address all subscription correspondence to Box 6226A, Northwest Station, Washington, DC 20015.

House Gets an Earful About Research Policy

On December 10, the day that four American scientists were receiving Nobel prizes in Stockholm, the House of Representatives Subcommittee on Science, Research, and Technology and the Subcommittee on Energy Research and Production marked the occasion by inviting in several past Nobel recipients and others to discuss science policy and related matters. Following are excerpts from those preceedings, which produced some unusually candid remarks:

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Burton Richter, Nobel laureate in physics, Stanford Linear Accelerator: I have been involved in many of these long-range planning exercises [for major research facilities] and there is one thing that is true about all of them. None of them ever meet their goal . . . There is a plan in high-energy physics for the next 10 years and it is quite modest and reasonable. It says that we are going to keep four labs we now have running . . . We will commit 20 to 25 per cent of the budget to new facilities. That is arrived at after analyzing obsolescence of existing machines and costs of new ones . . . It says, "The enterprise shall aim not to dominate the world research program but to be competitive."

A very reasonable set of goals. But the problem is that the funding doesn't match even those simple goals. Laboratories are running at less than 50 per cent utilization . . . and so we have seen in the last year or so much of the new and most exciting results of particle physics coming from Europe. . .

If one increases the budget, I think I would say you should be careful not to increase it too much. Too much money is bad for science . . . There is a second problem . . . Basic research, big science and most science is long-term . . . Perhaps if there could be some vague notion of what future funding levels will be like . . . I think it would aid basic science enormously, for we have to commit people and resources now to things which are not going to produce any answers for three or four years.

Rosalyn Yalow, Nobel laureate in physiology or medicine, Veterans Administration: Much has been made of the fact that in the past 20 years we have had 73 [Nobel] laureates in science compared to Great Britain's 22 and Scandinavia's five. But corrected for population, we are actually behind those countries. If we subtract off those Laureates credited to the United States but not born or educated here, we are at even a greater disadvantage . . . If we want to play the numbers game, we should examine why massive [US postwar research] spending did not improve our relative position and what the differences are that permitted the British to be equally successful at a much smaller cost.

It is not the amount of money, but how it is spent that is crucial . . . A decade ago . . . salaries of principal investigators, who were considered senior faculty, were paid by the school. After all, research is part of the faculty job. Now, however, it is quite common for half or more of the salary portion of a grant to provide for the principal investigator's salary. Because he is better paid than the pre- or post-doctoral students or technicians, a given salary budget now buys half as much . . . help as a decade ago.

What about overhead costs? Let us imagine the following situation — which is far from imaginary. A generous donor makes a substantial contribution to initiate the building of a $100-million monument to his name. The contributions are never completed and the school is left with a substantial mortgage, which must be funded . . . The school has overbuilt for prestige reasons and really needed only a third of the space for lecture rooms, laboratories and administration. It therefore assigns two-thirds of the space to research. Research overhead, the so-called indirect costs, is then required to provide two-thirds the cost of upkeep . . . The less successful the school is in getting grants, the more space they assign to each successful investigator, and the percentage overhead on these grants is increased proportionately.

What about the peer-review system? . . . Built into the system is a mechanism which is, for several reasons, inherently dishonest. For instance, few established

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Study Reports Young Applicants Doing Well in Research Support

Does tight funding tend to squeeze out younger investigators seeking research grants?

That's said to be one of the problems of our time, but according to a study in the journal *Cancer Research,* young applicants for National Cancer Institute grants have fared "much better than their older colleagues in terms of recommendation and award rates."

The study, by John T. Kalberer Jr., and Guy R. Newell, Jr., found that "In Fiscal 1976, the latest year of the study, younger investigators clearly surpassed older scientists in the percentage of both traditional grant applications recommended, 70.2 versus 60.8 per cent, and awarded, 52.6 versus 38.8 per cent of those recommended."

The average grant for the younger investigators was a bit less than for their seniors — $55,400 apiece, compared to $63,400. But the authors say that the money gap has been closing; also that "the disapproval rate for the older investigators was considerably higher than it was for the younger."

. . . The Problems that Money Cannot Solve

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investigators whose contributions are highly original and imaginative can spell out, as presumably is required in grant requests, detailed plans for a three- or five-year period. Furthermore, it is probably unwise for an investigator to disclose, and unlikely that he will disclose, to a peer-review group of rivals, a highly novel original idea, lest his priority dissipate ...

For the most part, superb talent in science can be identified in the early years of a career . . . Current mechanisms for research funding do not provide for identification or support of the truly imaginative . . . Large expenditures, as for instance, the over-funding of the National Cancer Institute, have not proven to be cost-effective . . . It is not necessarily true that more money increases the rate of discovery. It is important to identify early those with a flair for discovery and give them the freedom to develop . . . So few have this talent that large sums are not required for their support — and not too much is wasted if some mistakes are made. . .

If we are falling behind in science it is due in large part to problems that money cannot solve. Science should serve the people and be responsive to their needs, yet it is an elitist field. Discovery in science cannot be promoted by the popular will, but it can be impeded by the failure of popular support.

Philip Handler, President, National Academy of Sciences . . . please understand that American science has never been more successful than it is at this very moment. In all disciplines we do extremely well . . . [However] if you gentlemen [members of Congress] insist that the monies to support science are homogeneously distributed over 435 Congressional districts, which is a pressure that has been here ever since the Congress began to provide funds for science, you will not get a fair return on the money because the scientific talent is no longer so distributed. It is nucleated in several places of excellence. If you really want the highest return, that is where you will have to put the money . . . [The peer-review system] works reasonably well, but it has pressures put on it for geographic distribution of resources and to maximize this kind of distribution rather than asking what the very best scientists require . . . That is in part your doing. It is you who have given the sense of the American policy to the bureaucrats who run the federal agencies, and they have responded. You can turn that around as well. The pressure for accountability has indeed generated enough niggling red tape as to in some measure reduce the productivity of science itself. . .

We now find ourselves in a rather strange situation. Military R&D is something of the order of one-half the American [government's] total spending [on R&D]. I think that by its very nature it has drawn off much more than one-half of our most talented scientists and engineers . . . As the requirement is for the military to become more and more exotic, less and less related to the requirements of the domestic sector, we will have fewer and fewer real spinoffs which will feed back into the domestic economy, and yet we are forced into these circumstances and must learn to live with them.

Yahoo Time on Capitol Hill

During the December 10 House hearings on science policy, the following dialog took place between Philip Handler, President of the National Academy of Sciences, and Rep. Mike McCormack (D-Wash.), Chairman of the Subcommittee on Energy Research and Production:

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Handler: School science has deteriorated with the rest of the educational grade school and secondary school educational system in the United States.

McCormack: Isn't that possibly because of the fact that our standards are being set by underachievers who have control of the media?

Handler: Well, there are days when I regret the protection of the First Amendment, sir.

Research on Aging Expanded

The National Institute on Aging, part of the NIH system, says it is seeking project proposals for an expansion of social and behavioral research related to aging and "the place of older people in society."

According to an NIA announcement, the program, under the direction of Matilda White Riley, a sociologist of aging, will go beyond the previous interest in topics such as retirement, and bereavement, and will focus on three areas: "Older People in the Changing Society," and how they are affected by job and income patterns, housing, cultural changes, and other factors; "Psychological and Social Components of Aging," and "Older People and Social Institutions."

For additional information: Social and Behavioral Research, National Institute on Aging, 9000 Rockville Pike, Building 31-C, Room 5C27, Bethesda, Md. 20205; tel. (301) 496-3136.

Chemist Says Medicine is Siphoning Talent

Medical school enrollments hit a record high last year — 63,000, up 2.5 per cent from the previous year — according to the Association of American Medical Colleges. Though the federal government continues to agonize over the deluge of doctors that's on the way from these institutions, there's little prospect of a turndown. The newest freshman class, totaling 16,390 students, was spread among 126 medical schools, two more than the previous year's count. The newcomers, still to reach full capacity, are at the Universidad del Caribe, Cayey, Puerto Rico, and Oral Roberts University, Tulsa. The main bright spot in the medical school boom is that it's accompanied by improved admission opportunities for women applicants to those coveted student spots. Women now constitute 25.3 per cent of all medical students and 27.8 per cent of the current first-year class.

And where are the medical students coming from in this time of a slowdown in graduate enrollments? According to Douglas C. Neckers, Chairman of the Chemistry Department at Bowling Green State University, medical studies are drawing off a lot of top talent that formerly went into chemistry. As quoted recently in *Chemical & Engineering News,* Neckers says that various academic criteria clearly show a decline in the quality of chemistry students and a concurrent improvement in medical students. In a study supported by the Alfred P. Sloan Foundation, Neckers reported, it was found that the mean in class rankings for chemists and medical students in 1964 was in the 25th and 24th percentiles, respectively. By 1978, however, the medical students were up to the 16th percentile; chemists had dropped to the 39th.

Neckers conclusion: "Students of lesser ability are being fed into the American research establishment in chemistry. The trend is unmistakable and nearly 10 years old."

Meanwhile, the National Science Foundation reports that total enrollments in science and engineering programs at doctorate-granting institutions rose 1 per cent in the 1978-79 academic year (the latest for which complete figures are available). But, NSF found, there was a 7 per cent decline among first-year graduate students — "a drop three times as large as that reported for first-year graduate students in all fields of study."

NSF says the changes are "partially explained by the decrease in the number of baccalaureate degrees conferred in science fields during the 1976-77 academic year, down 1 per cent from the previous year."

Other factors in what NSF foresees as a continuing decline in fulltime graduate science and engineering enrollments are tuition increases, lower GI benefits, and attractive job offers for bachelor-degree holders in several fields of science and engineering.

(These and other data on graduate enrollments are in a four-page summary, NSF 79-321, available without charge from: Division of Science Resources Studies, National Science Foundation, 1800 G St. Nw., Washington, DC 20550.)

Graduate Enrollments

Rank	Institution	Total	Full time	Part time
1	Univ. of Southern California	7,000	3,200	3,800
2	Univ. of Calif.-Berkeley	5,500	5,300	200
3	Univ. of Wisconsin-Madison	5,100	4,500	600
4	Univ. of Minnesota	4,900	4,100	800
5	Ohio State Univ.	4,600	3,700	900
6	Univ. of Michigan	4,600	4,100	500
7	Univ. of Washington	4,400	3,400	1,000
8	Rutgers, The State Univ.	4,200	1,700	2,500
9	New York Univ.	4,200	1,600	2,600
10	Univ. of Illinois-Urbana	4,100	3,900	200

Note: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation.

NSF in "Appropriate" Technology

The National Science Foundation has established what it describes as "an experimental program in Appropriate Technology," which is defined as technologies that are "decentralized, require low capital investment, conserve natural resources, are managed by their users, and are in harmony with the environment." Application deadline: February 29.

For information about getting in on this: Division of Intergovernmental Science and Public Technology, Engineering and Applied Science Directorate, National Science Foundation, 1800 G St. Nw., Washington, DC 20550.

Lab Jobs for Minority Youth

Federal grantees interested in participating in a government-supported program to provide laboratory jobs for 1000 minority high school students during summer 1980 can obtain additional information from: Stanley D. Schneider, Office of Science and Technology Policy, Executive Office Building, Washington, DC 20500; tel. (202) 395-3840.

Britain: Lords Create Science Committee

London. Six months after Britain's general election brought the Conservative Party into power, significant changes are still taking place on the science-policy scene. The latest move, taken on 11 December, saw the creation of a new committee to oversee science and technology in the House of Lords.

The Lords — Britain's unelected upper house — made this move after the House of Commons Select Committee on Science and Technology disappeared in a total reorganization of the lower house's select committee system (SGR Vol. IX, No. 13). Select committees — so-called because their members are selected by the whole of the house — have no budgetary responsibility; rather, they act as watchdogs, questioning government departments, and the people they affect, and reporting to the House of Commons.

European Report

In the past the House of Commons set up its select committees on subject lines. Now a new committee system replaces this with a series of committees linked to government departments. Thus the old House of Commons Select Committee on Science and Technology is replaced by a Select Committee on Education, Science and Arts. Whereas the old committee would carry out investigations concerning a number of government departments, it must now stick to the Department of Education and Science.

One example of such an inter-departmental investigation that may now prove difficult under the new structure is that carried out by the now-defunct House of Commons Select Committee on Science and Technology into genetic engineering. Here the subject involved the work of the Department of Education and Science, the Department of Industry, the Ministry of Agriculture, Fisheries and Food, not to mention the Health and the Employment departments. Each department now has its own Select Committee and it isn't done for one committee to wander into the territory of another.

This loss of parliamentary freedom to pursue important topics produced some disquiet both in Parliament and in the scientific community when it was announced that the government favored the new committee system. While the desire to maintain the old science and technology committee never produced a strong campaign to defend it from abolition, it did spark off the moves that led to December's decision by the House of Lords to set up its own Select Committee on Science and Technology. To a certain extent this move could improve the treatment of science and technology in Parliament.

The old House of Commons committee was never renowned for its scientific knowledge or its investigative ability. Unlike American Congressional committees, the Commons' committee did not have a large staff, nor do individual members have the personal staff assistance commanded by Congressmen. Furthermore, most of the Science and Technology Committee's members were short on scientific understanding. The House of Lords, on the other hand, has a fair sprinkling of the country's senior scientists among its members, including the President of the Royal Society, Lord Todd. Thus, though the new Lord's committee will not have any more support than its predecessor in the House of Commons, its membership will be of a much higher professional calibre. The House of Lords has already proved that it can muster formidable scientific expertise: earlier Select Committees of the Lords have set up sub-committees on scientific subjects and these invariably produced better reports than the old Common's committee.

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In Print

Women Scientists in Industry and Government: How Much Progress in the 1970s? Some, but not enough, concludes this 55 page report, prepared for the White House Science Office by the Commission on Human Resources, of the National Academy of Sciences (2101 Constitution Ave. Nw., Washington, DC 20418), from which copies are available without charge.

The Impact of Regulation on Industrial Innovation, 64 pages, the product of an industry-dominated, get-the-government-off-our-backs meeting held in May 1978 under the auspices of the National Academy of Sciences and the National Academy of Engineering. Nothing much new here. Available without charge from: Office of the Foreign Secretary, National Academy of Engineering, 2101 Constitution Ave. Nw., Washington, DC 20418.

Research in Norway 1979, a magazine-format collection of articles on various research programs, including psychology, agriculture, meteorology, plus listings of scholarly periodicals and books recently published in Norway. Available without charge from Norwegian embassies and consulates, or from: Research in Norway, Munthegst. 29, Oslo 2, Norway.

Scientific Research in Israel 1979, 299 pages, a detailed catalog of Israeli organization and policy for research and development, plus a lab-by-lab account of research programs and related activities. Available, without charge, from: The National Council for Research and Development, Kiryat Ben Gurion Building, 3 Jerusalem, Israel.

. . . Mrs. Thatcher Says She's Science Boss

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It will be some time before either the House of Lords Select Committee on Science and Technology or the new House of Commons Select Committee on Education, Science and the Arts starts work. The Lord's committee has yet to choose a chairman, although Lord Todd is odds-on favorite; thus Parliament will have all but ignored science for nearly a year before any sign of action is visible. However, one small sign that Parliament hadn't quite forgotten science was a question in the House of Commons on the overall responsibility for science policy.

The questioner was Tam Dalyell, one of the few Members of Parliament to have shown a consistent interest in science for some years. When questioning Prime Minister Thatcher about the responsibility of different ministers for science, he elicited the usual reply that each department was responsible for its own area of concern, with the Secretary of State for Education and Science taking the lead when it comes to the Research Councils (which are akin to the National Science Foundation in support of basic research).

The surprise came when the Prime Minister turned to the issue of overall coordination of subjects that inevitably cross departmental boundaries. In the Labor government it was the Lord Privy Seal, Lord Peart, who oversaw, for example, the implementation of the customer/contractor principle of government funding of R&D. Mrs. Thatcher ended her parliamentary answer to Dalyell: "In appropriate cases I would play a coordinating role myself."

Thus the Prime Minister is the senior minister when it comes to science policy, a move that can be interpreted as either an improvement in the status of science or a downgrading, since it is difficult to see the PM finding much time to take science seriously.

There has been no sign of action on Mrs. Thatcher's part, but with the country's financial position occupying the attention of Parliament almost to the exclusion of everything else, there has been no call for action on science and technology. Just about the only topic that has raised its head in the past six months has been the financial plight of a research community which, like the rest of the country's public sector, faces severe cuts in the near future.—MK

Engineers Form New Society

The American Association of Engineering Societies, with 37 member organizations comprising about 1 million members, has been created as an expanded successor to the Engineers Joint Council. The newly formed association will bill each member society 65 cents a head, and says it will try to represent the interests of engineers in public affairs. Kenneth A. Roe, a New Jersey engineer, is President, and Carl Frey is Executive Director, a post he held with the now-defunct Council. The newly formed Association is headquartered in New York (345 East 47th St., New York, N.Y. 10017), but eventually plans to move to Washington.

Few Shifts Expected in Top Washington Science Posts

A few comings and goings are in the works in the ranks of Washington's science-policy community, but White House sources say they expect that the cast of characters will remain fairly stable for the rest of the year.

It was rumored for a while that Richard C. Atkinson, Director of the National Science Foundation, was tempted by an offer to return to academe, but he's decided to remain where he is.

Meanwhile, searches continue for a new Director for the National Cancer Institute, to succeed Arthur C. Upton, who's taking a post at New York University, and for David Hamburg, head of the Institute of Medicine, who's going to Harvard.

On Capitol Hill, this will be the last year in office of Senator Adlai Stevenson (D-Ill.), chairman of the Subcommittee on Science, Technology, and Space. He's had enough of the Senate and plans to retire.

Carter Names 20 for National Science Medal

The biggest batch of recipients ever named for the National Medal of Science — 20 of them — were honored January 14 at a White House ceremony. The medal, for which the late Theodore von Karman was the only winner when it was first awarded, in 1962, is the government's highest honor for achievements in research. It's usually given annually, but, for reasons unexplained, Jimmy Carter skipped it last year. Following is the list of the latest recipients and the work for which they were cited:

Burris, Robert H., of the University of Wisconsin, for his work on the biochemistry of nitrogen fixing.

Brosby, Elizabeth, University of Michigan, Ann Arbor, for her research into comparative human neuroanatomy.

Doob, Joseph L., University of Illinois, Urbana, for his work on probability and mathematical statistics.

Feynman, Richard P., a Nobel Prize winner from the California Institute of Technology, Pasadena, for his explanation of the behavior of subnuclear particles.

Knuth, Donald E., Stanford University, for his design of efficient algorithms which form the basis of computer programs.

Kornberg, Arthur, Stanford University, for research into the reproduction of DNA

Leith, Emmett, University of Michigan, for his pioneering work in holography, the process of making three-dimensional images with lasers, and its application to science.

Mark, Herman F., Polytechnic Institute of New York, Brooklyn, for advancing the study of polymers, large molecules used in synthetic fibers such as nylon.

Mindlin, Raymond D., Columbia University, for his work in mechanical engineering and theoretical mathematics and his research into piezoelectric oscillators.

Noyce, Robert N., chairman of the Intel Corporation, Santa Clara, Calif., for his work on semiconducter devices for integrated circuits.

Ochoa, Severo, Roche Institute of Molecular Biology, Nutley, N.J., a Nobel Prize winner, for his discoveries involving the individual cell's citric acid cycle, through which it manufactures energy.

Parker, Earl R., University of California, Berkeley, for advancing the understanding of how materials react under stress and pressure.

Purcell, Edward M., Harvard University, a Nobel Prize winner, for his research into atomic structure and interstellar magnetic fields.

Ramo, Simon, vice chairman of the board, TRW Inc., for his development of microwave electronics.

Sinfelt, John H., Exxon Corporate Research Laboratories, Linden, N.J., for his work on innovative catalytic systems which remove pollutants from automobile exhaust.

Spitzer, Lyman, Jr., Princeton University, for his theory of star formation and for his research into using fusion energy.

Stadtman, Earl R., chief, Biochemistry Laboratory of the National Health, Lung and Blood Institute, National Institutes of Health, Bethesda, Md., for explaining the metabolic process of anaerobic bacteria.

Stebbins, George L., Jr., University of California, Davis, for his development of a theory of plant evolution.

Weiss, Paul A., Rockefeller University, New York City, for his contributions to understanding the nervous system, including the basis for surgical repair of peripheral nerves.

Weisskopf, Victor F., Massachusetts Institute of Technology, for his work in particle physics and on nuclear reactions.

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